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DESIGN AND COORDINATION OF NAVY MANAGEMENT INFORMATION SYSTEMS

by

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PREFACE

Computer based management information systems theoretically increase the amount of useful information which can be supplied to top layers of management. The Secretary of Defense has attempted to utilize this advantage of the information technology as a means to aid decision making at his level in the Department. By obtaining increased information about the operation of the Department of Defense, the Secretary is aided in his desire to make decisions about defense resources and policies on an overall basis rather than in increments.

To obtain information for the Secretary of Defense, and to improve management of its own assets, the Department of the Navy has been directed by the Secretary of Defense to utilize fully the new information technology. The result is that several computer based management information systems are being implemented throughout the naval establishment.

Critics of the Department of the Navy's efforts to utilize information technology feel that the Department is installing systems too rapidly without the necessary organization or technical ability to make effective use of new concepts in management information. The purpose of this thesis is to explore to what extent this criticism is warranted. Research has been directed toward answering the question: "Is the Navy able to coordinate

properly its growing number of management information systems?"

Chapter I contains a discussion of the impacts on management and organization which are likely to result from the new technology, the accepted methodology for systems planning and design, and the organization within the Navy for design and coordination of management information systems. The content of the chapter is intended to establish a basis from which to analyze the Navy Department's goals and procedures for information system design and coordination.

Chapter II describes several of the most important Navy management information systems. Little attempt is made to analyze these systems since the purpose of including them is simply to illustrate the scope of the management information program in the Navy, highlighting the large amount of management information which must be manipulated, and the extent of overlap or duplication which might exist.

Chapter III narrows the scope of the analysis to the actual planning, design, and attempts to integrate the most comprehensive management information system in the Navy, the Navy Maintenance and Material Management Information System, providing a means of determining if the Department of the Navy has the proper organization and technical competence to systematize its information gathering functions.

The analysis is primarily based on research of publications of the Department of Defense, the Department of the Navy, the

Logistics Research Project at The George Washington University, and interviews with personnel in the bureaus and major offices of the Navy.

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CHAPTER I

MANAGEMENT INFORMATION THEORY

The New Information Technology

A computer based information system should not be considered simply as a system to process data *per se*, but should be envisioned in the broader context of a management system for the direction and control of an organization. Consequently, when an information system is being planned, pertinent management theories and concepts need to be taken into account. A discussion, then, of how management theory is affected by the new information technology is appropriate as a background for an analysis of the planning and coordination of management information systems in the Navy Department.

A two-pronged result is apparent in the effects computers have on organizations. Organizations are changed as a result of studies made possible by the computer, and they are affected by the computers' direct impact.

J. W. Forrester illustrated the first part of this dichotomy when he studied the effect of information on organizations.[1] By utilizing a computer for his work on the theory of

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[1] Jay W. Forrester, *Industrial Dynamics* (New York: John Wiley & Sons, 1961), p. vii.

information-feedback systems, he was able to develop a basis for understanding the goal-seeking, self-correcting interplay between the parts of a business system. He did this by simulating social systems through the use of experimental models. Social systems are too complicated to be reduced to mathematical formulation but can be studied through simulation since the computer is a practical, economical tool for the vast amount of information required.

In 1960, academicians and industrial managers met at the University of Chicago for the purpose of discussing the actual applications of computers in industry.[1] Discussing what they called the "new information technology," these experts observed how management and organization are affected by the following three areas: (1) the use of mathematical and statistical methods, with or without the aid of electronic computers; (2) the use of computers for mass integrated data processing; and (3) the direct application of computers to decision-making through simulation techniques.

George P. Shultz and Thomas L. Whisler, when writing about the Chicago conference, mentioned several ways in which the conferees thought management concepts would be changed.[2] The most

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[1] George P. Shultz and Thomas L. Whisler, Management Organization and the Computer (Glencoe, Illinois: The Free Press, 1960), p. 2.

[2] Ibid., p. 7.

far-reaching change, of course, is that managers have a greatly increased knowledge about the organization's operation and environment. Also, the design of systems and the use of models require logical, concise assumptions and judgments about the firm in question. As a result, the machines compel managers to formulate their decisions so much more intelligently and more thoroughly than they ever have that they can hardly be unaware of the shortcomings of their programs.[1]

Shultz and Whisler feel that this information technology should move out the boundaries of decision making. Individual decisions will be made by top executives which cannot be made at high levels now. The flow of factual, day-to-day information can be moved higher in the corporation, helping the large business to function like the small one in which all aspects of the business are more readily carried in mind and correlated to the decision making process. Top management will be able to make more detailed decisions, much as the top executive of a small company does now.[2]

Writers such as Stahrl Edmunds have also recognized the impact on the organization resulting from an increased flow of information. He has suggested that faster communications should eliminate many of the poor or late decisions caused by an inability

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[1] Gilbert Burk, "Will the Computer Outwit Man?," Fortune, October, 1964, p. 121.

[2] Shultz and Whisler, op. cit., p. 9.

to force information through layers in the organization. Similarly, since information can flow without regard to functional or other organizational fences, the desirable objective of promoting common goals among executives should be more reachable.[1]

The Chicago conferees saw the information technology as an integration of smaller systems into larger ones. They pointed out that the people most affected by such integration are those who formerly coordinated these systems. Most of the literature on this subject supports the premise that the ranks of direct line supervision will be thinned, and the structure of organization should become somewhat flatter and perhaps have fewer departmental boundaries. Problems of interdepartmental coordination should diminish in proportion to the scope of the development of the integrated information systems.[2]

Shultz and Whisler take a stand on the decentralization issue. "Our argument," they say,

> is that use of the high-speed computer and associated techniques--information technology--will be a force for centralization of decision making, along with an expanded staff at the top levels and fewer jobs, with more highly programmed content, at lower levels in the management hierarchy.[3]

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[1] Stahrl Edmunds, "The Reach of an Executive," Harvard Business Review, January-February, 1959, p. 74.

[2] Bernard J. Muller-Thym, "The Real Meaning of Automation," Management Review, June, 1963, p. 43.

[3] Shultz and Whisler, op. cit., p. 28.

Other writers, such as John Deardon, are not as convinced about the centralizing tendency.[1] Most of the writers who disagree with Shultz and Whisler claim that there will be centralization of planning and control; however, operations will be decentralized. There is a vague difference in the two points of view.

Shultz and Whisler believe that decentralization has resulted because modern industry was just too large and complex to be organized any other way. The advent of rapid and comprehensive information gathering devices should eliminate the one rationale for decentralization, the inability to communicate rapidly in the large organization. The largest consensus of any point discussed at the Chicago conference was that the pressures for change generated by the introduction of the new technology are in the direction of centralization of decision-making, of control, and of coordination.[2]

Information System Design Methodology

Keeping in mind those management concepts likely to emerge from a properly planned system, the next step is to examine the relevant, recognized methodology for the planning and design of an information system.

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[1] John Deardon, "Can Management Information be Automated?," Harvard Business Review, March-April, 1964, p. 135.

[2] Shultz and Whisler, op. cit., p. 9.

The "total-systems approach" is the current vogue in systems design. It requires that a system design be completely documented with exhaustive descriptions and blueprints. The present and future organization must be depicted in detail, as must the system tasks to be performed. Thus an improved information system cannot be designed until the objectives and needs of the organization in question are explicitly known and the existing system is clearly understood. Nor can the new system be considered fully implemented until it is operating and accepted--intellectually and emotionally--by those who work with it.[1]

The writings of experts in the field of systems planning and design usually reflect agreement on several steps necessary to accomplish this total system. The steps include a study of the organization, a determination of its long-range objectives, a definition of the system being used currently, making short-range improvements to the existing system, establishing a time schedule and assigning responsibility for meeting the schedule, and accomplishment of the plan.

Study the Organization.

Judith Moss, senior systems analyst with General Electric, believes that every organization has a unique personality which must be understood before any meaningful and workable plans can

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[1] John E. Ryan, "Upgrading a Company's Information System," Automation, August, 1964, pp. 48-52.

be made.[1] Thus, one of the first steps in systems design is to obtain a biography of the organization, what it does, and policies or personnel in its management, as well as a feel for any political or personality ramifications.

Information of this type can be obtained from organization and policy manuals and statistical and accounting data. The prime source, however, is discussion with officials and operating personnel who may be qualified to translate raw statistics into a meaningful picture. This can also highlight contrasting views and bring out any differences in management thinking as well as an awareness of present problems and possible solutions.

With such background information on the organization, it is then possible to delve into the objectives of the program. Who initiated it? What level of management has approved it? Will it be conducted by insiders, a consultant, or an equipment manufacturer? Are the stated objectives, if any, realistic, too narrow, or too broad?

Other questions that should be resolved include: Is the program being initiated because of some obvious failure in the current operations? Or because some improvement can be made? Are there any time restrictions on the study? What constraints have been set by existing management policies? A very obvious

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[1] Judith Moss, "Planning a Management Information System," Automation, August, 1964, p. 58.

constraint, of course, is the budget allowed for the study. This must be realistic in terms of objectives and complexities.[1]

Determine the Long Range Objectives

The long range objectives (3-5 years) and a design for an information processing system that will enable the organization to operate more effectively with minimized managed costs must be determined.[2] The objectives are determined by visualizing the general nature of the organization five years hence, including probable changes in end product (mission or tasks in the military) and major changes in physical assets, and the external demands upon the organization. With a general concept of these conditions in mind, the next step is to visualize the information and data required by each element of the organization to enable the whole to meet these demands. These information requirements range from those needed by the productive worker in a shop section to those needed by the general manager for decision-making, planning and control purposes.[3]

Development of such "system specifications" is a job which requires participation on the part of all functional management. But such participation must be on a functionally unbiased basis, and planning at this stage must be done without regard to how the

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[1] _Ibid_., p. 59.

[2] Westinghouse Corporation, "Business Systems Analysis and Planning," A Planning Manual, not dated, p. 2.

[3] D. S. Stroller and R. L. Van Horm, "Design of a Management Information System," The Rand Corporation, P-1362, November 22, 1958, p. 3.

organization is currently structured or how the system operates now.[1]

System objectives may be precise, such as requiring that each supervisor be provided daily with a detailed schedule of his manpower and workload for the next three days. Or the objectives may be phrased more broadly, stating that certain actions will be accomplished in a specified time period. In any case, one of the objectives will always be to reduce managed cost by specific, scheduled amounts with predetermined contributions to efficiency.

Following the system specification stage is the creative process of planning and designing the new system. Planning and design is considered the most critical element in the success of the entire program by some writers on systems design.[2] It is the phase in which the highest conceptual skills of the professional systems man must be brought to bear to insure complete integration of the various subsystems which eventually constitute the total system. Concurrently with this process, an analysis of the present system should be undertaken.

The Present System

A detailed analysis of the present system is useful and economically justifiable from several standpoints. First, such

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[1] Robert D. Bernhard, "Providing Timely Production Data," Automation, March, 1964, p. 50.

[2] Alan D. Meacham and Van B. Thompson, Total Systems (American Data Processing, Inc., 1962).

analysis reveals improvements that can be made without basic systems changes. These are improvements from which savings can be realized quickly and in quantity sufficient usually to pay for the investment in time and effort involved. Second, the analysis provides the starting point for planning the intermediate systems involved in the transition to the ultimate system. Third, the analysis provides an invaluable "check list" of system requirements, preventing small but important details from being overlooked in the planning of the ultimate system.[1]

The large number of facts gathered on the present system must be arranged in such a manner as to be adequately understood.[2] To facilitate arranging the facts, some specific analytical techniques are used by large corporations and are described in textbooks on the subject. These techniques include multi-dimensional flow charting, input-output analysis, physical layout of the system, and identification of managed costs.

Multi-dimensional flow charting organizes facts in order to trace the flow of data from origin to destination.[3] Flow charting arranges this flow in chronological sequence of operations as information progresses through the organization, summarizing the entire procedure in simple, precise form that enables more

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[1] Moss, op. cit., p. 59.

[2] Westinghouse Corporation, op. cit., pp. 81-86.

[3] Victor Lazzaro, Systems and Procedures (Englewood Cliffs, N. J.: Prentice Hall, 1959), pp. 71-84.

objective study of all the parts. The dimensions of volume, time, cost and physical distance for each step are included. Each is an important factor in any considered plan for mechanization or other improvement; depicting them on the chart for each processing stage aids in objective analysis. The flow charting process may be likened to the product flow charts used by manufacturing plants, or the mathematician's use of symbols.

Each step revealed by the flow chart should be examined and questioned critically: Does it contribute fully to the end objective of the organization? Is it necessary at all? Determining the true reason for a step being done often establishes that it is no longer necessary. Is this the best time and place in the processing cycle for it to be done? Is there a simpler, easier, less costly way to do it? Asking each of these questions at every step will result in consideration of all the possibilities for improvement of the existing process. The flow charting principle can be expanded into other useful areas of analysis such as forms flow and distribution, punched card and computer procedures, and organizational process flow.[1]

Input-output analysis is the visual portrayal of the source data going into a system and the documents being generated as output.[2] Efficient systems design requires that all input data

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[1] _Ibid_., pp. 33-62.

[2] Richard N. Schmidt and William E. Meyers, _Electronic Business Data Processing_ (New York: Holt, Rinehart and Winston, 1963), p. 154.

entering the system be useful, that duplication of data input be eliminated, and that costly rehandling after the first stage be eliminated. Most of the information required for this type of analysis is already available from the process flow charts. The input-output chart simply rearranges it in a format that will facilitate comprehension and quickly point up duplication of effort. The principal benefits are:

(1) Elimination of repeated processing of the same information--one of the most costly and wasteful practices, yet one of the most difficult to recognize in a complicated system.

(2) Minimized regeneration of information--the handling and rehandling of identical data.

(3) Easier and more objective appraisal of mechanization feasibility. Analysis of this type is useful in bringing out the full potential of mechanization.

A new system or systems revision must be coordinated with a plan for proper layout.[1] Space and layout surveys trace the flow of work among people, desks, files and equipment. Superimposing this flow on a two or preferably three-dimensional scale layout of shop and office areas provides the visual means for recognizing and analyzing ineffective use of available space. Typical accomplishments include:

(1) Eliminating backtracking and bottlenecks.

(2) Conserving the use of space and energy by eliminating detours and paper shuffling.

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[1] Lazzaro, op. cit., p. 49.

(3) Improving working conditions by minimizing physical transport and providing physical proximity of required facilities.

(4) Reducing lines of communication.

The final step in defining the present system is to identify the managed cost involved and the functional and "people" responsibility for each element of cost, including the effects of performance in one function upon managed costs in another.[1] Identification of cost is necessary in order to put the present system into dollar perspective. It will also provide a basis for selecting areas of greatest potential efficiency, insure that the proper operating personnel are brought into the picture at the right time, and point out to these people their responsibility for managed costs in the operation in functions other than their own.

Recommendations for improvements in a given function must always be considered in relation to their effect upon other departments and personnel. Most have to do with the main stream of the organization and therefore impinge upon many related areas. Logistics, for example, is closely related to operations, maintenance and other functions.

Make Short-Range Improvements[2]

Making short-range improvements utilizes the pay-as-you-go principle and is one of the common short-range goals. Throughout

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[1] Westinghouse Corporation, op. cit., p. 85.

[2] Moss, op. cit., p. 60.

the analysis of the existing system, factual information is being gathered and digested--good ideas are being sifted out and tentative improvements identified. Many of these improvements are of a nature that can be effected immediately without changing the long-range objectives, as a result of eliminating or combining steps, changing the sequence of operations, reducing delay time, and otherwise simplifying procedures. Often these changes can be implemented without appreciably disturbing normal activities. Most systems analyses to date have demonstrated an ability to (1) produce immediate savings in excess of the cost of the program; (2) contribute markedly to improved efficiency; (3) provide step-by-step accomplishments toward the longer-range objectives; and (4) develop the knowledge and skill essential to eventual integration of systems.[1]

Care must be taken, however, to insure that such improvements are in fact fully compatible with long-range objectives; otherwise, they become false economies and may slow progress toward the ultimate system.

Establish a Time Schedule

A time schedule must be established and responsibility assigned for accomplishment of the long-range objective. The lengthy and far-reaching nature of most long-range systems studies

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[1] McKinsey and Company, Inc., A Survey of Twenty-seven Leading Companies with Long Computer System Experience, September, 1964.

requires that each phase be carefully planned, responsibilities assigned and a schedule developed for its accomplishment. This need becomes particularly critical when a joint effort is involved. Without it inertia develops that must ultimately be overcome.[1]

Full consideration must be given to the interrelationships of different phases of the program. Working within the broad confines of the study as a whole, it is then possible to schedule and assign each of the phases, making use of overlapping or parallel actions and other time-saving devices in order to meet the schedule. Minor adjustments can be made as circumstances dictate, but always within the context of the total plan.

Accomplish the Plan

With proper preplanning, orientation, and training of personnel, accomplishment of the plan can then proceed logically to completion. Each step must be documented fully to insure that the solution fulfills the objectives; alternatives are weighed; equipment considered; conversion procedures are developed and tested; physical requirements are determined; controls are developed; installation and follow-up are carried out according to plan; and results measured.[2]

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[1] Westinghouse Corporation, op. cit., p. 9.

[2] Ibid., p. 10.

Successful accomplishment requires follow-up to insure that all replaced procedures have actually been discontinued, that all parts of the new system are in operation, and that results live up to expectations. Subsequent review on a periodic basis should also be formulated.

Throughout the development and installation of the program the long-range objectives should be reexamined and modified as necessary in the light of changing conditions. The best long-range plan is a flexible one, and it can be expected that changes in it will be necessary as implementation progresses.[1]

Assign Responsibility

To accomplish a major systems improvement requires that the responsibility for system analysis, design, and planning be vested in a single person.[2] In this manner the necessary coordination between functions and the resolution of different points of view can be obtained. Because all functions of the organization are involved, the program director should fill a staff position reporting no more than one step down from the head of the organization.

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[1] Henry H. Albers, Organized Executive Action (New York: John Wiley & Sons, 1962), p. 423.

[2] Ruth M. Davis, "Military Information System Design Techniques," ed. Edward Bennet, Military Information Systems (New York: Praeger, Inc., 1964), p. 25.

Assignment of the responsibility to a committee in which all members participate on a part-time basis will likely delay the project and reduce its ultimate effectiveness. Committee action will also be extremely susceptible to functional bias by the stronger members.[1]

Ruth Davis of the Mitre Corporation suggests that the responsibility requires the full time of a man who knows the techniques of system analysis and is capable of grasping new and advanced systems concepts and taking full advantage of their application in the organization.[2]

Train the Assigned Personnel

Because this program involves relatively new concepts, there is a need for training of the individuals who will be assigned the responsibility for carrying it out.[3] Moreover, the rapid pace of technological development requires that training be updated periodically. Training and indoctrination will probably be the key to how successful the installation of the new system will be. Even before conducting a feasibility study, and definitely before installing the system, personnel must be conditioned for change.[4]

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[1] Gordon L. Lippit, "When is a Committee Necessary?," American Society of Association Executives Journal, VIII, 4 (October, 1956), p. 5.

[2] Davis, op. cit., p. 27.

[3] Albers, op. cit., p. 423.

[4] Harold J. Leavitt, Managerial Psychology (Chicago: The University of Chicago Press, 1958), p. 133.

The Navy Management Information Program

Initially in this chapter the impact of the "information technology" on management and organization as observed by academicians such as J. W. Forrester and Thomas Whisler was described. In addition, the recognized methodology for designing computer based information systems was discussed. This design methodology is recommended by the most successful practitioners of systems design in current writings on the subject.

It is interesting to note that an instruction published by the Department of the Navy in 1959 entitled, "Data Processing in Navy Management Information Systems," contained many of the same concepts which have been discussed here.[1] The Secretary of the Navy indicated in the above publication that he had a fairly clear idea in the late 1950's as to what was required to implement a fully integrated management information system. While the methodology proposed by the Secretary of the Navy at that time was not completely refined, it nevertheless encompassed most of the procedures in systems design which are now proposed by industrial and independent analysts.

In 1959, the Navy was completing the fourth stage of a plan calling for six stages of automatic data processing applications. The six stages cover the years from 1940 until 1970.

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[1] U. S. Department of the Navy, SecNavInst P10462.7, Data Processing in Navy Management Information Systems, April 16, 1959.

Stage four was the first stage during which equipment that was actually feasible for the job intended for it was procured in quantity. Stage four was described by the Secretary of the Navy as essentially an initial acquisition and earliest feasible applications, quick pay-off, and pilot installation period.[1]

During stage four the responsibility for planning and implementing ADP applications at appropriate facilities fell to the individual managing bureaus. Only towards the end of the initial implementation was it suggested that the management bureaus and major offices collaborate towards developing overall Navy management information systems plans.[2]

During stage five, which is now nearly complete, the plans call for a much more comprehensive application of automatic data processing in the Navy Department. The objective of stage five is as follows:

> The objective of this stage is not only to bring about substantial improvements during it in the use of ADPS in management. The objective is also, at or near its end, to have equipped the Navy with a full complement of systems equipment and personnel having the capability of achieving the long-range objectives of this program, insofar as the kind of equipment labelled "ADPE" can contribute. It will remain for stage 6 to convert the capability to a perfected routine actuality.[3]

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[1] *Ibid*., p. II-2.

[2] *Ibid*., p. II-3.

[3] *Ibid*.

The long-range objectives envisioned for stage six include an integrated system as indicated by the following description:

> It is expected that early in this stage the Navy will have installed (and interconnected), a full range of ADP equipment, with adequate technical personnel on board, having the capability to attain all the long-range objectives of this program. It is expected that at the end of this stage, those objectives will be routinely achieved throughout the Navy in actual hourly operations. Therefore, developmental activity during the period will be chiefly in the perfection of the best ways and means for management to constitute itself and use the advanced hardware and technical personnel--with a very high degree of common characteristics Navy-wide. The end result of stage 6 should then be the ultimate exploitation of "Automatic Data Processing Systems" in AN INTEGRATED NAVY MANAGEMENT INFORMATION SYSTEM.[1]

The above referenced instruction, published in 1959, suggested that many of the management concepts as seen by the academicians would be embraced in the Navy. Furthermore, it explained how the Navy should go about making this happen. For instance, it described in some detail the benefits which would accrue from a feasibility study and the procedures to follow in conducting a feasibility study. It also outlined the procedures to be followed in order to design the system, e.g., input analysis, output analysis and work flow diagraming.[2]

The instruction had outlined in considerable detail the Navy's goal in setting up its management information system, but

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[1] *Ibid.*, p. II-4.

[2] *Ibid.*, pp. IV-1, VI-6.

failed to establish concrete bureau-by-bureau objectives. The instruction indicated that the Secretary of the Navy knew what should be done in the management information area; nevertheless, his office failed to stimulate the bureaus to move forward rapidly in installing management information systems. The most glaring example of this alleged failure is that the Navy's bureaus did not begin implementing comprehensive computer based management information systems until seven years after the Air Force had installed workable systems.[1] This belated action was not taken until the Department of Defense, in effect, ordered that it be done.[2]

While it appears that the Navy has been slow in embracing the information technology in management systems, it does not necessarily follow that the systems which are being installed are poorly designed. The purpose of the following chapters will be to explore to what degree the Navy has been able to utilize the recognized methodology for the design and coordination of information systems, and to what extent the expected impacts of the new technology have materialized.

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[1] U. S. Department of the Navy, OPNAV INST 4700.16, Standard Navy Maintenance Management System, March 8, 1963, p. 1.

[2] U. S. Department of Defense, DOD INST 4700.19, Equipment Distribution and Condition (EDAC) Statistical Reporting System, July 15, 1964.

CHAPTER II

NAVY MANAGEMENT INFORMATION SYSTEMS

To illustrate the magnitude of the task and the problems involved in designing and coordinating management information systems within the Navy, it will be useful to briefly describe several of the more important systems being implemented. The systems described here do not represent all the Navy systems; even so, these systems will indicate to what degree there is overlap and duplication inherent in the present individual bureau-by-bureau approach to obtaining management information. Considerable detail as to the objectives, the source data entering the system, and the management products derived will be included under the assumption that these will be the areas in which possible duplications might exist.

Navy Cost Information System (NCIS)

One of the most comprehensive systems in the Navy is its cost information system, which parallels the functional responsibility of the Assistant Secretary of the Navy for Financial Management. The Office of the Navy Comptroller, the guiding light

for NCIS, is developing the system in conjunction with representatives of all major components of the Navy Department.[1] The system will be the financial information component of any integrated Navy management information system. It is a functional system that crosses organizational lines, for the scope of the NCIS includes any unit that maintains and reports cost data used by higher levels in the Navy Department.[2]

The Navy Comptroller claims that NCIS is playing an important role in the planning-programming-budgeting-appraisal cycle. It is intended to be the vehicle for the input of financial data which, when wedded to program data, becomes a meaningful expression for management decisions, review and appraisal.[3]

The first phase of a financial management improvement program which includes NCIS will reshuffle the Navy financial management system to consolidate all aspects of the five-year force structure and financial program, budgetary requirements, and the accounting system into one compatible streamlined system. The

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[1] Victor Longstreet, Assistant Secretary of the Navy for Financial Management, Informal remarks made to the author on February 4, 1965.

[2] Cdr John W. McCabe, "Navy Cost Information System," unpublished paper produced for the Office of the Navy Comptroller, Washington, D. C., 1962.

[3] Interview with Robert Green, Office of the Navy Comptroller, Data Processing, November, 1964.

consolidated system is intended to satisfy Navy needs as well as the requirements of the Department of Defense. At present, the computer-supported Navy Cost Information System supplies statistical data used in the compilation of the five-year force structure and financial program; whereas the accounting system furnishes data for the basic budgetary requirements. Sometimes the material is compatible, but frequently, valid comparisons are difficult because of the disparate data bases. So, the first major step in the improvement program is to insure compatibility of all data from which financial management information is derived.[1]

After accomplishing this goal, the plan is to adapt the system to the associated systems such as personnel, procurement, facilities, supply and contract management. Accounting, budgeting, programming, data processing, auditing, and management engineering personnel have been marshalled to help reach both goals. The consulting firm of Management Systems, Cambridge, Massachusetts, is also assisting in a system design.[2]

The primary motivation for an improved information system came when the Secretary of Defense instituted the concept of programming Department of Defense objectives on a total resource

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[1] Walter J. Kennevan, "Automation and Financial Management in the Navy," The Armed Forces Comptroller, December, 1964, p. 25.

[2] Rear Admiral Morris Hirsch, Deputy Comptroller, Department of the Navy, Address before the Navy Financial Management Class, February 9, 1965.

basis. This forced the Navy into a need for providing data on forces and their costing on a different basis than was called for by the existing management and financial structure. The financial data on forces had to be compatible with the programming structure as well as the existing appropriation structure. At the same time, the Navy and Marine Corps did not want to distort their programs and financing.

In August, 1962, the Office of the Comptroller in the Navy Department published a description of the inputs and outputs of this system in a pamphlet entitled, "Program Change Control System in the Department of the Navy."[1] The inputs are in the form of standard accounting data with one important exception: the individual items are coded according to each major program aspect such as activity, item, appropriation, etc.

With the aid of computers the Navy Comptroller is able to use these data to produce management reports or outputs having several uses. The Secretary of Defense for his analysis receives costs in terms of program elements subdivided into three categories: research and development, investment, and operations. The Department of Defense budget requirements for cost information are presented in terms of appropriation and subdivision listing. The Navy accumulates data in terms of the force structure, the

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[1] U. S. Department of the Navy, Office of the Comptroller, NAVEXOS P-2416, Program Change Control System in the Department of the Navy, August, 1964, p. 5-2.

supporting forces and related costs. Finally, for purposes of cost effectiveness measurements and weapon decisions, reports relate forces to procurement items, research and development, military construction projects, and the associated costs.[1]

These management products relate to financial management for six years, in that they involve current operations, are used for budget year calculation, and enter planning considerations projected another four years. The ongoing year operations must be reported in terms of the outputs. Working in the other direction, whenever a budget is constructed or a change to the five year force structure is contemplated, the financial information must also be convertible into each of the outputs.[2]

It was originally intended that all financial information would flow from the field activities through the Navy Finance Centers to the Navy Comptroller, and subsequently be distributed to anyone having a need for it. The bureaus disliked having the information pass through the finance channels before they had access to it and forced a change so that data would be collected and analyzed by the bureaus and then sent to the finance centers.[3]

Mr. Robert Green, data processing specialist in the Navy Comptroller's Office, has described how the activity cost

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[1] _Ibid_., p. 5-3.

[2] _Ibid_., p. 5-4.

[3] Hirsch, _loc. cit_.

information is actually made into line item information and program information by machine processing.[1] Following is the flow of the system as he described it: (1) the accounting at the cost center level is tied into the five-year force structure by coding; (2) at the bureau level the accounting information is placed on a machine in order to prepare tapes for the Navy Comptroller; (3) the Navy Comptroller then analyzes this tape information on the finance center machine and sends tapes to the Navy Command Control System Support Activity where the data are processed and reports are prepared in the form of program elements.

Related systems under development include one by the Chief of Naval Operations which is a ship planning system. The system is intended to provide and maintain current data on ship inventory and status, conversion and overhaul schedules, ship equipment allowances, and tempo of operations. The ship planning data will be identified to naval cost centers to insure that ships forces and their associated costs are aligned to the same program element. A similar system is being developed for aircraft.[2]

Cost and Economic Information System (CEIS)

Cost and Economic Information Systems are presently being established throughout the Defense establishment. The systems are

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[1] Green, loc cit.

[2] Program Change Control System, loc. cit.

intended to close that portion of the cost information loop outside the Department of Defense. Cost and Economic Information Systems collect and analyze actual and estimated cost and related information pertaining to the acquisition of weapons systems and major items of equipment. The systems also collect and analyze employment and related economic impact data.[1]

By establishing these systems the Secretary of Defense intends to improve cost estimating, cost and price analysis, and program reporting. Such improvement should enhance the effectiveness of planning, programming, budgeting, contract negotiating and program or project management. The economic impact data will enable the Secretary of Defense to analyze contracting impact by geographic area and industry.

This last objective is a touchy subject, and one that most federal officials are loath to discuss. With this information the Secretary of Defense can assess the economic effects of slowing procurement, speeding it up or terminating contracts. Action can then be taken to minimize or maximize this impact, depending on the circumstances.[2]

The Cost and Economic Information System develops comparable cost and related data on weapons systems and major items

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[1] U. S. Department of Defense Directive 7041.1, <u>Cost and Economic Information System</u>, July 7, 1964, p. 1.

[2] Interview with T. W. Harris, U. S. Department of the Navy, Office of Navy Material, November 12, 1964.

of equipment. Cost data encompass the full acquisition cycle (research, development, engineering, preproduction and production) for uniformly defined systems, subsystems, major components (such as propulsion, guidance, structure, support equipment) and other activities for aircraft, missiles, space systems, ships, electronic systems, armor, ordnance and other weapons and support systems. Economic data will encompass plant and geographic employment data on Department of Defense contractors.

Data sources include contractor reports and reports prepared in-house by Department of Defense components (i.e., reports or procurement and industrially funded activities). The reach of the system should extend to the third tier of subcontractors.[1]

As the Navy's part in this system, it will be expected to establish one or more cost analysis organizations to:[2]

1. Organize and manage the Cost and Economic Information System as a single integrated system.

2. Insure the validity, comparability and timeliness of actual cost and related data obtained from contractors.

3. Develop techniques for cost estimating and analysis.

4. Provide a central point of storage and retrieval of data.

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[1] Interview with Commander Robert S. Haley, U. S. Department of the Navy, Bureau of Naval Weapons, Accounting and Budgeting, November 5, 1964.

[2] DOD DIR 7041.1, op. cit., p. 2.

5. Make available analyses of cost and related data within the Department of Defense to program, budget and contract analysts, program or project managers, industrial readiness planners and economic analysts.

The Navy Department must assure coordination between the appropriate cost analysis organization and the weapon system or equipment project manager in applying uniform work breakdown structures, standardized cost definitions and data validation. Additionally, other systems providing the same or similar cost information must be identified and eliminated in order to avoid duplication of effort. Eventually the Cost and Economic Information System will be integrated with other systems (including PERT/Cost) used for accumulating cost information.

The computer will fit into this system at several points. It is envisioned that major contractors and subcontractors will collect the necessary data for the required reports and place it on their machines. These machines and the machines at the cost analysis centers will exchange information in machine readable forms. Within the Defense establishment information will be passed from machine to machine depending on the need for the particular data. Then, at some future time, a central data bank for information which is applicable to more than one cost analysis center can be established.[1]

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[1] Haley, loc. cit.

The Navy Maintenance and Material Management Information System (MMMIS)

The Department of Defense has directed that each service have a Maintenance Management Information System based on computer technology to ensure rapid measurement and reporting of military readiness, economic effectiveness, and engineering deficiencies concerning war material.[1]

The objectives of the Standard Navy MMMIS will be to provide a uniform system for reporting pertinent information regarding all maintenance performed afloat and ashore. The material management portion of the MMMIS is more in the nature of a supporting endeavor to assure that appropriate materials are available on a timely basis to those concerned with maintenance.[2]

This system will integrate and distribute maintenance data which are being documented in a uniform data collection system referred to as the Maintenance Planning and Control System. Uniform maintenance-action documentation and uniform maintenance-information reports to management are implied by MMMIS.[3]

In addition, MMMIS has the potential of accommodating cost standards and effectiveness measures as management tools.

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[1] Interview with Jack Whitten, U. S. Department of the Navy, Bureau of Naval Weapons, (FWMP), November 5, 1964.

[2] U. S. Department of the Navy, Instruction 4700.16, Standard Navy Maintenance Management System, March 8, 1963, p. 1.

[3] Frank W. Segal, "Maintenance and Material Management Information System Research Considerations," Technical Memorandum, Logistic Research Project, The George Washington University, February 13, 1964, p. 4.

Different effectiveness measures, such as a military worth measure designed for use at the managerial level, can be integrated into a uniform MMMIS. Similarly, an operational readiness measure such as a Material Readiness Index can be utilized at various administrative levels through a MMMIS. The Navy's complex weapons require management techniques such as cost accounting, effectiveness measures, and operational readiness measures for efficient management and operation.[1]

Most of the Navy effort to date has been expended on the input side of the system. A comprehensive program has been underway for several years to standardize maintenance publications, planning, procedures, and terminology throughout the Navy. Also, a detailed research effort has been undertaken concerning documentation. First, the needs for maintenance information at all levels were determined by statistical sampling. Then, a standard source document was developed as the result of a detailed study of selected maintenance activities, based on the needs for information at higher levels.[2]

Research has also been done on the reports required after the source information is gathered. The Office of Naval Research has almost completed this stage of the implementation program.

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[1] *Ibid.*, pp. 5-10.

[2] Interview with Dr. Robert Lundegard, U. S. Department of the Navy, Office of Naval Research, Code 436, December 9, 1964.

To a considerable extent the required reports determine the type of machine installation. The plan now is to have key punch operations aboard ships and stations and then send the cards to a central facility. Some base complexes will have computers to prepare local reports; however, duplicate machine cards will be sent to the central data facility for processing and preparation of bureau and department reports. This central processing will be done at The George Washington University for about two years and then be phased over to a central Navy facility.[1]

The program has several problems. The intent of the system is that only one document will be required at the maintenance activity for all maintenance and supply actions. The accuracy of this input is a problem. Also, many records such as aircraft log books are to be eliminated, which is difficult because of a certain reluctance by many to trust the system.

The output of the central processing facility will be in three forms: (1) periodic reports; (2) reports generated by an action taking place outside of established parameters; and (3) reports resulting from an inquiry. Coordination and standardization of these reports within the limits of the system and the needs of the manager will be difficult.

The integration of the maintenance information system with the supply system is presently causing some difficulty. For

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[1] Interview with Commander W. E. Fannin, U. S. Department of the Navy, Office of Naval Research, Code 436, November 5, 1964.

instance, the intention of the maintenance managers is to use the document recording the maintenance as a requisition document. Department of Defense requirements for uniform supply documents thwart efforts in this direction.[1]

This system is an attempt by the military to take advantage of the management concepts made possible by the new information technology. Mathematical and statistical models are used for military worth and cost effectiveness measures. There is mass data processing, and simulation procedures are used for planning and scheduling. Through these measures the ability of top Department of Defense managers to make decisions, to control and to coordinate Defense activities should be enhanced.

Personnel Management Systems

The systems used in the Bureau of Personnel are not in the strictest sense management information systems. They are inventory control systems, with people constituting the inventory. Since most of the management information systems in the Navy list the gathering of personnel information as one of their objectives, it is important that the personnel management systems be meshed with the other systems. Therefore, as an aid in determining if this is being accomplished, two of the newer systems and the old

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[1] _Ibid_.

personnel accounting system are discussed here.

An attempt to more effectively coordinate personnel planning with weapons system planning is evident in two personnel systems. MOON is the code name for the Enlisted Personnel Simulation System. CAPRI is the acronym for the Computerized Advanced Personnel Requirements Information program.[1]

The Enlisted Personnel Simulation System (MOON) is intended to horizontally measure the manpower skills in the Navy through a projection of personnel inventory by rating of Navy Enlisted Classification. MOON gives the Navy the capability to correlate the manpower "experience" strength of the navy-wide skills and the skill requirements for projected programs. Many variables, such as changes in policy or force sizes, can be tested on mathematical models by the bureau to determine projected requirements. The bureau intends to buy experience quickly for its managers through these simulation procedures.[2]

While MOON is used for horizontal measurement, the Navy plans to use CAPRI to provide a vertical measurement and integration of manpower skills. The primary objective is to integrate personnel planning and training with the development and installation of new weapon systems. In effect, personnel will be

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[1] Captain Nicholas Brango, U. S. Department of the Navy, Bureau of Naval Personnel, Address before the Navy Financial Management Class, January 29, 1965.

[2] Ibid.

considered as a subsystem of a particular weapon system so that both will be planned concurrently, ensuring the availability of trained people when the weapon system goes on line. MOON will monitor progress, detect difficulties and signal the information necessary to allow correction. Most of the poor timing and coordination of new crews and new construction should thus be eliminated.

The above projects are operating in addition to the long established personnel accounting systems. These systems depend primarily on the standard reporting methods normally used in administration, and use machines only as a means of maintaining files on tape. Source document automation is not presently being instituted, since up to now it has presented insurmountable problems.[1]

The three main areas of personnel information which overlap several bureaus are skills, costs and distribution by activity. An analysis of the coordination of several systems may indicate where this information can be more efficiently integrated. MOON and CAPRI certainly seem to constitute a step in that direction.

Medical Information System

The objective of the Bureau of Medicine and Surgery is to achieve an integrated data processing system which permits the recording on tape of all the chronological information involved

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[1] Ibid.

in the care of a patient. An integrated system includes admission data, diagnoses, treatments, response to treatment and patient disposition. The recording of workload factors involved in providing direct and indirect patient care is one of the major benefits of the system.[1]

The central file of the system is to be located at the Medical Center, Bethesda, Maryland. The second tier of administration is located in several regional centers throughout the United States. The source information is generated at the local installation level and forwarded to the regional centers. In turn, the regional centers furnish statistical data and medical information to the local units as necessary, and to Bethesda in summary form.

The accumulation of a data bank of clinical and statistical data is extremely valuable to the bureau. The ultimate goal, however, as seen by many in the medical service, is the integration of clinical <u>and</u> management data collection, consolidation and analysis. The integration aids immeasurably in the planning and development of facilities in addition to the professional benefits derived.[2]

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[1] U. S. Department of the Navy, Bureau of Medicine and Surgery, NAVMED P-5069, <u>Data Processing Management Handbook</u>, Washington, D. C., 1964, p. 5.

[2] F. G. Anderson, Jr., "Automatic Data Processing and Hospitals," (Unpublished Term Paper, BA 218, The George Washington University, 1965).

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Facilities Information System[1]

The Bureau of Yards and Docks is developing an integrated data processing capability to meet its business data, engineering simulation and engineering computational needs. At the present time, accounting information and limited engineering reliability information constitute the scope of the program. However, the bureau has a contract with Management Technology, Incorporated to develop an integrated capability for a comprehensive system which will include both administrative and engineering information.

Shipyard Management Information System[2]

The Bureau of Ships has not been aggressive in developing modern information systems. The closest set-up it has to an automated information system is the shipyard data processing system. This supplies detailed financial information and provides reports for standards usage, work center performance, direct labor analysis, schedule performance, and force distribution. The capability exists for making long-range workload forecasts on the basis of ship overhaul or conversion requirements.

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[1] U. S. Department of the Navy, Bureau of Naval Yards and Docks, Plan for Establishment of ADP Installations, August 5, 1964.

[2] U. S. Department of the Navy, Bureau of Naval Ships, Bureau Headquarters "Business Type" Data Processing Program, September 30, 1964.

The bureau plans to integrate its data processing under the control of the Data Systems Policy Group chaired by the Assistant Chief of the Bureau for Administration. It is anticipated that automatic data processing (ADP) in the many field activities will be linked with ADP at the Bureau in specified critical information areas. This would present the Bureau with a management information center covering most aspects of ship building and repair functions.

The Maintenance and Material Management Information System previously described will provide the Bureau of Ships with maintenance information relative to all ships. The information systems for fleet maintenance, shipyard repair, and new construction are interrelated. No written policy guidance explaining how all these information sources would be integrated has been made available to the author.

Reliability Assurance Program[1]

Data retrieval and computer analysis are integral parts of the reliability assurance program used in the development of naval weapon systems. The computer provides the means to correlate and integrate data from three main areas of the reliability cycle.

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[1] U. S. Department of the Navy, Special Projects Office, "Reliability Maturity Index," (memorandum description of the extension of PERT to reliability assurance, Washington, D. C., 1964).

Starting with prediction, the computer aids in establishing reliability specifications and general operating parameters for the reliability framework of the system under consideration. It is then used in the reliability analysis and evaluation of designs prior to release to ensure that all selected parts meet the system environmental and life requirements. This function is aided by analysis and evaluation of operational performance reports received from the field. After analysis and classification the data are worked into various reliability files and models. The feedback data of field or test stand operational performance given to the reliability and prediction groups are what makes reliability assurance effective.

Several other systems are closely aligned to this system and have as one of their objectives the retrieval of reliability information.

Uniform Automatic Data Processing Systems for Industrial Naval Air Stations[1]

The primary objective of the Bureau of Weapons in implementing this system is to keep a high percentage of fleet aircraft and missiles in the air--or ready for launching. To do this the Bureau has planned real-time data processing systems for

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[1] U. S. Department of the Navy, Bureau of Naval Weapons, Improved Fleet Readiness Through Automatic Data Processing Systems for Industrial Naval Air Stations (a pamphlet prepared by the Radio Corporation of America, undated), pp. 1-16.

Industrial Naval Air Stations. These systems will do a management information task in four major areas: Fleet Readiness, Overhaul and Repair, Supply, and Finance.[1]

Fleet Readiness involves responsibility for making expeditious allocation of the fleet workload among various Overhaul and Repair facilities. To carry out this mission, the Fleet Readiness Representative must be immediately aware of the exact capabilities at the various Overhaul and Repair facilities and supporting activities at any given time and for the foreseeable future. He also must assure that adequate equipment and personnel are available throughout various levels of support and repair activities, and be completely informed regarding immediate and anticipated workload. The Bureau of Naval Weapons feels that the successful execution of the Fleet Readiness function demands an ability to directly interrogate a central data bank. In simpler terms, the Fleet Readiness Representative must be able to push a button and get an immediate answer.

Overhaul and Repair use of the systems is planned primarily for workload control. Workload control involves the planning, scheduling and control of labor, material, and production facilities which are required to meet Fleet Readiness dates. Workload control, therefore, encompasses three major functions: Planning, Scheduling and Reporting.

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[1] Letter by Captain J. A. Laurich, U. S. Department of the Navy, Bureau of Naval Weapons, Data Processing Officer, 1964.

industrial Naval Air Stations. [illegible] system will be a management information tool in four major areas: Fleet Readiness, Material and Repair, People, and Finance.[1]

Fleet Readiness involves responsibility for making statistical allocation of the fleet aircraft among various Overhaul and Repair facilities. To carry out this mission, the Fleet Readiness representative must be immediately aware of the rework cap-bilities at the various Overhaul and Repair facilities and supporting activities at any given time and for the foreseeable future. He also must ensure that adequate equipment and personnel are available throughout various levels of support and repair activities, and be routinely informed regarding inventory and anticipated workload. The nature of [illegible] make the [illegible] of the Fleet Readiness function depend on ability to directly interrogate a central data bank. In similar terms, the Fleet Readiness representative must be able to pose a question and get an immediate answer.

Material and Repair use of the systems is planned primarily for workload control. Workload control involves the planning, scheduling and control of labor, material, and production facilities which are required to meet fleet readiness goals. Workload control, therefore, encompasses three major functions: planning, scheduling and reporting.

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[1] Notes by Commander J. R. [illegible], U. S. Department of the Navy, Bureau of Naval Weapons, Data Processing Office, 1966.

Planning--The Overhaul and Repair Department (O&R) is notified periodically of the number and type of aircraft to be delivered, and the dates on which they are to be returned to the fleet. From Work History Files, the O&R requirements for each aircraft are determined. Each major work assembly (engine, undercarriage, etc.) is "exploded" to determine total parts requirements. These totals are processed against Ready for Issue inventories, Previous Commitments and Replacement Histories. The result leads to determination of the net parts needed for the manufacturing or ordering cycle. Simultaneously, labor availability records are assessed in order to schedule the required man-hours.

Scheduling--As aircraft are received by O&R, man-hours are scheduled, material is requisitioned, and work stations reserved. A detailed work procedure is issued which identifies the number and sequence of operations to be performed on each unit. This application also requires the capability of complete rescheduling to accommodate priority work orders.

Reporting--Execution of this schedule triggers release of information required to control production, order material, handle employee pay records, and provide comprehensive cost data.

Supply (Material Control) involves up to 10,000 daily transactions. To meet the needs of this application, the data processing equipment must gather, process and distribute data relating to 250,000 to 350,000 stock items worth a half-billion

dollars or more at each industrial naval air station.

Financing this operation is a complicated undertaking. In view of such a massive production and inventory problem it is apparent that the data processing system must provide a comprehensive accounting so that the exact amount of each transaction can be recorded and summarized for the Comptroller. The Comptroller Department provides technical guidance, coordination and advice in budget preparation, review and execution; recommends allocation of civilian personnel to departments and programs; develops and monitors data collection systems for program performance analysis and progress reporting; provides accounting and disbursing services; and maintains a program of internal review and assistance.

The first management information became available from this system on approximately March 1, 1965, and will grow in volume throughout 1965.[1]

Military Essentiality Through Readiness Indices (METRI)

METRI is primarily an analytical technique; however, it will depend for its practical use on a detailed information retrieval system. The definite similarities between this program and the Maintenance and Material Management Information System, which the Bureau of Weapons and the Bureau of Ships are

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[1] Ibid.

implementing, are pertinent to an analysis of information system coordination in the Navy. The concepts of material readiness models in each program are especially alike.

The Office of Research and Development of the Bureau of Supplies and Accounts contracted with the research firm of Clark, Cooper, Field and Wohl to develop an improved decision making technique for the Bureau. What the Bureau needed was a concept which would integrate the vast amount of fragmented information concerning material condition into a structure from which decisions could be made. METRI was the result.[1]

Clark and Cooper et al. explain METRI as a technology to quantitatively measure and report on certain aspects of the readiness of military units to carry out defined missions and to provide a valid basis for decision-making.

The technique is based on construction of a model to represent the fleet in total, including every subdivision down to the smallest system or subsystem. The fleet model will essentially be a tier of models built one on the other in a dependent chain. Thus, every component or man contributing to the completion of a task will have a functional relationship built into the models. Just how essential to readiness each of these contributing entities is can be expressed numerically on a scale 0 to 1.[2]

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[1] U. S. Department of the Navy, Bureau of Naval Supplies and Accounts, METRI, Military Essentiality Through Readiness Indices, Pilot Program Report, December, 1964, p. 2.

[2] Ibid.

The model is constructed to cover any desired depth or scope of operations--everything from the fleet as an entity at the top to the individual bits and pieces at the bottom. Each ship, function, system, or component with its subcomponents is plotted. The model not only includes items of equipment but personnel, money, food and all items that affect the performance of the ship.

The one consistent justification for each system described thus far is readiness measurement. Most of the decision-making problems facing management of naval forces center on the ability to measure the military performance of units or forces within a variety of environments. The bureaus, as evidenced by the stated objectives of their information systems, are concerned with budget requirements and the allocation of resources made avilable to the fleet afloat and to the logistics support ashore in order to maintain a high readiness posture.

The Bureau of Supplies and Accounts has expressed the same concern for allocation to increase readiness, and is trying to answer a series of questions regarding the distribution of resources and the return on investment that can be expected as a result of decisions made. For example, how to determine the value of trade-offs between "reliability of equipments" versus "maintainability of equipments by personnel" or "intense training of personnel" versus "additional manpower on board"? Would it be better to increase the inventories both ashore and afloat or to

improve transportation and communication between supply sources? Would it be better to add on maintenance tools, equipment and skills aboard ship rather than use tender support or yards for the more sophisticated repairs? Would it be better to have redundancy of equipment aboard ship rather than back up inventories and trained maintenance personnel?[1]

The Bureau regards these and many other questions as having a direct effect on the performance of the force unit and feels they must be recognized when decisions are made regarding allocation of funds.

A prototype (force-unit) model, the USS ELLISON, is being used by the Bureau of Supplies and Accounts to test and evaluate the possible applications and problem-solving techniques of METRI in the areas of design, personnel, maintenance, inventories, etc. The Bureau claims that results attained will assist management in the acute problems of budget requirements and resources allocation. It further claims that each of these areas of interest can be analyzed using the test model for evaluating possible solutions to problem areas.[2]

Summary

The systems described here operate in addition to the classified systems such as those for ordnance reporting, fuel oil

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[1] U. S. Department of the Navy, METRI, (unpublished pamphlet describing METRI, not dated), p. 12.

[2] Ibid.

management, tactical data, and other command and control systems. Information retrieval is a vast and complicated business in a large military organization.

A pattern becomes readily apparent in a review of these brief descriptions of management information systems used within the Navy. It shows that each bureau and major office has an information system which appears to have caused or emphasized several problem areas in the Navy's information retrieval efforts.

Undoubtedly, several of these information systems overlap each other. For instance, both Military Essentiality Through Readiness Indices and the Navy Maintenance and Material Management Information System have as one of their prime objectives material readiness measurements of the same equipments. Additionally, many of the systems report both financial and personnel information from the same activity (e.g., naval air stations, naval ships, or naval hospitals).

It is apparent from an analysis of the planning information available for the individual systems that each one is in a different stage of development. The Bureau of Yards and Docks has just begun a study for a system. On the other hand, the Bureau of Weapons has nearly completed the installation of its Industrial Naval Air Station systems and has been charging forward on MMMIS.

While it can be seen that there is a considerable amount of duplication within the Navy in its approach to management information, it is, nevertheless, difficult to envision how the

vast amounts of information necessary for managing the Navy can be efficiently integrated into one comprehensive system. Additionally, it becomes clear that each bureau believes that it must manage and control its own information system in order to perform its function. This is illustrated by the resistance the Navy Comptroller experienced when attempting to have the bureaus report information through the finance centers before they were able to analyze it. The bureaus insist that the information flow through the bureaus and then to the Comptroller, as necessary. Whether the bureaus are correct in this stand or not, the feeling persists and must be considered in working towards an integrated system--if that is to remain the Navy's goal.

An attempt will be made in the next chapter to determine how effectively the Navy is moving forward in this area. Since it is beyond the scope of this report to analyze the planning and the attempts to coordinate every management information system within the Navy, the Maintenance and Material Management Information System (MMMIS) will be singled out for a detailed analysis. The remainder of this report will include an analysis of the thinking behind this program, and what attempts have been made to integrate it into the broader context of an overall Navy management information system.

The MMMIS program was selected for analysis because it reports personnel, financial, and material data in addition to maintenance data. If any system would need coordination with the

other Navy systems, most of which report only financial or personnel information, etc., this would undoubtedly be that system.

CHAPTER III

PLANNING AND COORDINATING NAVY MANAGEMENT INFORMATION SYSTEMS

The Navy is currently in the process of developing an information system for maintenance and material management. This chapter will be presented in the form of an analysis of the planning and design of this system, and the attempts to mesh the interfaces of it and other information systems. The material will include progress made since the inception of the program in 1963 until the present. The intent of this analysis is to determine if the Navy is utilizing the proper methodology in implementing information systems.

Background and Organization

Project Group

In January, 1963, the Chief of Naval Operations (CNO) issued OPNAV Instruction 5420.48 establishing the Maintenance and Material Management Project Group for the purpose of recommending to the Deputy Chief of Naval Operations for Logistics implementing action to improve the material readiness of the fleet through

better management of the maintenance and material functions.[1] The Bureau of Ships had been working on this same general problem starting in 1962.[2]

Policy Committees

Along with the creation of a Maintenance and Material Management Group at Norfolk, OPNAV Instruction 5420.48 established two Washington based committees to coordinate and direct the efforts of the Norfolk operation. These committees were a Steering Committee under the chairmanship of the Assistant Chief of Naval Operations for Logistics, and a subcommittee of the Steering Committee, known as the Staff Working Group (SWG), to be chaired by the Executive Secretary of the Steering Committee.

The Steering Committee, composed of high level personnel from the Chief of Naval Operations staff and bureau representatives, is a policy-making body. It is kept informed of both progress and significant problems in its area of interest through periodic reports by its subcommittee, the Staff Working Group.

The Staff Working Group, directly responsible to the Steering Committee, has the following primary missions:[3]

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[1] U. S. Department of the Navy Instruction, OPNAV 5420.48, Maintenance Material Project Group, Establishment of, January 15, 1963, p. 1.

[2] Interview with Frank W. Segal, The George Washington University Logistics Research Project, November 6, 1964.

[3] Maintenance Material Project Group, Establishment of, loc. cit.

> The development of a standard maintenance planning and control system that will provide for the uniform accomplishment of planned preventive maintenance in all ships and aircraft squadrons of the operating fleet.
>
> The development of a system for collecting, processing, analyzing, and distributing feedback information that will enable line commanders and bureaus to better carry out their management functions in support of the operating forces.

The implementing program to achieve these objectives was set forth in OPNAV Instruction 4700.16 of March 8, 1963. This instruction provided a time-phased plan of action for the installation of a standard maintenance planning system, and a related Maintenance and Material Management Information System (MMMIS).[1]

Research Study Team

To facilitate the design of the information system, the Staff Working Group, in July, 1963, established a subcommittee called the Research Study Team under the chairmanship of the Office of Naval Research.[2] The Research Study Team membership included representatives from the bureaus, Chief of Naval Operations (OP-43), Office of Naval Material, Fleet Work Study Group Atlantic, Office of Naval Research, and The George Washington University Logistics Research Project. The primary objective of the Research Study Team was the development of a research program to determine the quantitative requirement for an information system

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[1] U. S. Department of the Navy Instruction, OPNAV 4700.16, Standard Navy Maintenance Management System, March 8, 1963, p. 1.

[2] Staff, The George Washington University Logistics Research Project, A Survey of Information Requirements for Navy Maintenance and Material Management, Serial T-170, April 15, 1964, p. 2.

> The development of a standard maintenance planning and control system that will provide for the uniform accomplishment of planned preventive maintenance in all ships and aircraft squadrons of the operating fleets.
>
> The development of a system for collecting, processing, analyzing, and distributing [illegible] information that will enable line commanders and echelons of higher [illegible] and fleet management functions in support of the operating forces.

The implementing directive to achieve these objectives was set forth in OPNAV Instruction 4790.2 of March 6, 1963. This instruction provides a step-by-step plan of action for the installation of a standard maintenance planning system and a related Maintenance and Material Management Information System (MMMIS).[1]

Research Study Team

To facilitate the design of the information system, the [illegible] [illegible] group, in July, 1963, established a [illegible] called the Research Study Team under the chairmanship of the Office of Naval Research.[2] The research study team then consisted of technical representatives from the bureaus, Chief of Naval Operations (Op-43), Office of Naval Material, fleet type commanders, Office of Naval Research, and the George Washington University Logistics Research Project. The primary objective of the research study team was the development of a detailed program to determine the qualitative requirements for an information system.

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[1] U. S. Department of the Navy, Chief of Naval Operations, OPNAV Instr. 4790.2, Standard Navy Maintenance Management System, March 6, 1963, p. 1.

[2] Ibid., the George Washington University Logistics Research Project, A Survey of Information Requirements for Navy Maintenance and Material Management, Serial T-171, April 15, 1964, p. 4.

as a necessary prelude to its ultimate system design.

A description and analysis of how the above organization for maintenance improvement has evolved in practice will afford insight into how well the organization was conceived.

Maintenance and Material Management Project Group

The Maintenance and Material Management Group, located at Norfolk, was assigned to work on the management improvement program in two stages. The problem would be approached in terms of first standardizing maintenance and then developing an information system. The Navy's rationale in this operation was that it would be necessary to get the maintenance house in order before meaningful data could be gathered for an information system. Once this was accomplished, an information system would help keep the standardization program intact.[1]

The Planned Maintenance System

As its first task in the improvement program the project group developed the Planned Maintenance System. This system is primarily pointed towards preventive rather than corrective maintenance. As an example, it systemizes the conduct of aircraft inspections by combining in convenient decks of Maintenance Requirements Cards (MRC's) for every type aircraft, information

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[1] Standard Navy Maintenance Management System, loc. cit.

previously contained in the Handbook of Inspection Requirements (HIR) and Handbook of Maintenance Instructions (HMI). The Maintenance Requirements Cards and the Periodic Maintenance Requirements Manual explain in what way inspections have to be performed, how they should be performed, what skills, tools, special equipment, etc. are required for their performance, what safety precautions should be observed, and in what sequence individual inspection actions should be accomplished. They provide this information in a form readily accessible and understandable by managers, planners, schedulers, and supervisors as well as workers.[1]

Logistics Research Project personnel claim that the Navy is getting several basic results from this planned maintenance.[2] Because maintenance procedures are now thoroughly documented in maintenance manuals, the Navy can utilize certain personnel in maintenance tasks which require abilities in excess of those implied by their rated skills. Standard documentation will result in a more uniform maintenance data base which will provide more consistent and valid inputs to maintainability/availability models. These models should improve maintenance procedures and engineering, resulting in a longer life expectancy for maintained assets.

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[1] U. S. Department of the Navy, <u>Naval Aviation Maintenance and Material Management Manual</u>, November 15, 1964, p. I-2.

[2] Frank W. Segal, <u>Maintenance and Material Management Information System Research Considerations</u>, Technical Memorandum, The George Washington University Logistics Research Project, p. 18.

It is reasonable to expect reduced retraining of maintenance personnel who are shifted from one location to another because of the uniform maintenance procedure. In a situation where different activities practice different procedures in maintaining the same kind of asset, it is necessary to tailor the training of technicians to the particular activity where they are stationed. Maintenance personnel that are transferred from one activity to another require retraining in these circumstances.

Unscheduled maintenance actions will be minimized, and a shipboard schedule of Planned Maintenance System should permit a time distribution of planned maintenance which minimizes the down time of components/equipments systems. Stated in equivalent terms, the Planned Maintenance System permits maximization of the ship's material readiness for war.

Naval air stations and carriers will be able to implement a schedule of planned maintenance permitting a time allocation of planned maintenance which minimizes the turnaround time of aircraft.

Standard Maintenance Planning and Control System (MPCS)

Developing a Standard Maintenance Planning and Control System was the second task undertaken by the project group. The above system provides the data collection and data control portion of the overall uniform Navy maintenance and material management system. It includes the Maintenance Planning System, but is more

comprehensive in that it collects data and provides the monitoring controls over planned maintenance.[1]

One other system was implemented by the project group with the help of the Research Study Team. An information system (MMMIS) was required to verify the validity of the assumed basic results of the Planned Maintenance System (PMS) and to guarantee at a specified level of significance that no slippage was occurring in PMS efficiency. An information system assures that adequate information is transmitted to management so that it will know if the expected performance of the Planned Maintenance System is being maintained.[2]

The Maintenance and Material Management Project Group instituted the Maintenance Planning and Control System, and as its first *direct* contribution towards developing a complete information system, collected data for an initial input analysis. A brief description of the initial data collection and analysis phase of MPCS is contained in the following paragraphs.

Source Data and Data Validation Procedures. The Data and Data Validation Program conducted by the Project Group was essentially a Navy Service Test involving AFM 66-1 procedures and techniques. AFM 66-1 is the designation for the U. S. Air Force

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[1] *Project Group, Establishment of*, *op. cit.*, p. 3.

[2] *Ibid*.

equivalent to MMMIS, and was used as a MMMIS prototype by the Navy.[1]

This test was begun by the Project Group in cooperation with The George Washington University Logistics Research Team in September, 1963. The units supporting the test from its inception were DESRON 32, the USS SIERRA (AD-18), the USS FORRESTAL (CVA-59), Oceana Naval Air Station, Norfolk, Virginia, and Carrier Air Groups 6 and 8. Three Air Force maintenance forms and the exception man-hour accounting concept were adopted for use in the test. All of the collected data were keypunched on location and sent, on a monthly basis, to the Logistics Research Project for processing.[2]

This initial data processing consisted of subjecting the Maintenance Data Collection (MDC) and the parts used data to a data admissibility test which the Logistics Research Project refers to as a Data Validation Procedure. A data admissibility test served as a filter which permitted only those Maintenance Data Cards and Parts Used Data Cards having permissible entries to continue on in the data processing system. Cards collected through the Maintenance Planning and Control System (MPCS-I)

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[1] Segal, op. cit., p. 28.

[2] Frank W. Segal and Thomas C. Varley, Maintenance Planning and Control System--Phase I, A Description of MPCS Data and Data Validation Procedure, Technical Memorandum, The George Washington University Logistics Research Project, July 24, 1964, p. 3.

containing entries in the data fields that did not pass a certain test were rejected.[1]

In a report prepared by the Logistics Research Project two conclusions were made on the basis of the early tests on the data from MPCS-I.[2] These conclusions were: (1) the ability of naval units to record and collect maintenance information that contains a reasonably low incidence of error is apparent, and (2) with modifications to the procedures such as uniformity of data submission, the incidence of error would be reduced considerably for some participating activities and increase the value of the collection system to all users.

The Logistics Research Project plans to continue accumulation of a data base on the service test of AFM 66-1 in order to support a supply phase of MMMIS research. This will give insights into the effectiveness of the maintenance operating level reports generated by the Navy MPCS. Also, the test will bring considerable information to bear upon the problem of designing management type reports to fulfill Navy requirements. Additionally, the service test will help develop an audit procedure, the location of data processing facilities, and the basic maintenance-action recording documents.[3]

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[1] _Ibid_., p. 1.

[2] _Ibid_., p. 2.

[3] Segal, Research Considerations, _op. cit_., p. 28.

Research Study Team

As stated in the description of the organization for maintenance improvement earlier in this chapter, the Research Study Team was formed to assist the Project Group in determining the requirements necessary for an information system. Basic to this effort, in the view of the Research Study Team, was the determination, through the device of a Formal User Survey, of the requirement for maintenance and material information at each management and command level.[1]

Satisfying Managers' Needs at Least Cost

The principal objective of the User Survey was to obtain insight into the design of alternative Maintenance and Material Management Information Systems (MMMIS) alternatives ultimately to be evaluated on a cost versus effectiveness basis. From the standpoint of the MMMIS design study, costs were held to be related to the quantity and complexity of data which would have to be generated by personnel performing maintenance actions; effectiveness measures were related to the incremental advantages (in terms of management improvements) which resulted from successive additions of data. While the User Survey was not designed to develop explicit cost data or cost effectiveness criteria, it did

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[1] Staff, Logistics Research Project, <u>Survey of Information Requirements</u>, <u>op. cit</u>., p. 2.

have as an objective the delineation of alternative data systems (alternatives in terms of integral MMMIS's, the integral systems varying in terms of a specific quantity and complexity of data) with a description of the potential end products inherent to the most basic system and to increasingly more refined data collection systems.[1]

The Research Study Team designed the User Survey with certain objectives in mind which would be complementary to a best system determination. First, they would assess, by specific activities, management levels, and functional areas, the Navy's requirement for maintenance information. The concern with functional areas is related to an interest in evaluating data requirement commonality and uniqueness over major management areas; e.g., maintenance management *per se*, and material effectiveness management (reliability, maintainability, availability).

This assessment of requirements, through a survey questionnaire, was designed to provide information on the fundamental level of organization at which particular commands or functional area managers require maintenance information. In addition, the Research Study Team wanted to know the requirement for identification information to particularize: (a) the object of the maintenance action (the hardware entity on which maintenance

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[1] *Ibid*., pp. 2-5.

is being performed), and (b) the resources (material and man-hours) consumed in maintenance actions. Also it was necessary for particular commands and functional area managers to know the requirement for specific data elements which describe the nature of the maintenance action, or the operational history of equipments prior to the maintenance action.

The Research Study Team planned to assess, by commands and functional area managers, the required timeliness of reporting of maintenance information (daily, weekly, monthly, quarterly, annually, exception basis). Information in this area was considered essential to the ultimate selection of data processing and communications equipment to effect a full-scale, operational MMMIS program.

Finally, the Team would specify, through an analysis of information made available by the survey of the content of reporting forms generated as a direct result of maintenance actions, the information content of master files, the availability of which was also considered essential to the operation of a MMMIS data processing center.[1]

Management Products

The latest task being undertaken by the Research Study Team is the exploration of the product potential inherent in the MMMIS data collection program. Through such exploration it hopes

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[1] *Ibid*.

to afford Navy management an insight into the growth in decision power made possible by a growing maintenance management system capability.

In November, 1964, the Logistics Research Project published a report describing the product potential of MMMIS.[1] It included the presentation of management data in two broad forms: (1) management data made available through an interrogation service to satisfy unscheduled requests by Navy customers for answers to specific questions, and (2) management information provided through routinely generated reports which have the characteristic of being prepared on a controlled schedule with a prescribed format.

A three-phased program has been established for management product development, the schedule for executing the three phases being related to Logistics Research Project assumptions on the time periods in which required input data files will be available at the Research Data Processing Facility. The exact dates of these phases will depend on data availability. The following schedule specifies, for each of the three phases: (1) the data files which are required to execute the particular phase, (2) the general class of products which can be planned for development

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[1] Marvin Denicoff and Henry Solomon, Description and Scheduling of Management Products for the Navy Maintenance and Material Management (MMM) Program. Technical Memorandum, The George Washington University Logistics Research Project, November 13, 1964.

assuming the availability of the specified data files, (3) the general time period in which the products will be available for distribution. While the Navy objective is to develop products of the type described for the assigned time period, questions of priority of customer requirement tied to considerations of data, subsystems and programmer availability will dictate the actual list of products to be readied for distribution.[1]

<u>Phase I</u>

Data Requirement: Maintenance Specific Data
Product Class: Maintenance Activity and Man-Hour Products
Reliability-Usage Data Products

<u>Phase II</u>

Data Requirement: Maintenance Specific Data
Catalog File
Wage Rate File
Product Class: Cost Accounting Products
Advanced Man-Hour Products
Planning Factor Products
Validation Products

<u>Phase III</u>

Data Requirement: Maintenance Specific Data
Configuration File
Planning Data File

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[1] <u>Ibid</u>., p. 5.

Product Class: Advanced Reliability-Usage Data Products

The Logistics Research Project will work on product development as a continuing process. In addition to adding to the list of management reports with new reports as new requirements materialize, they foresee each of the products growing in sophistication and value. These improvements are expected to result from such factors as (1) increasing range and depth of available data, (2) improved knowledge of customer needs, (3) increasing employment, through expanded knowledge of customer requirements, of management by exception principles.[1]

A Conceptual Framework

As indicated in the foregoing analysis, a framework has been developed for the implementation of a Maintenance and Material Management Information System (MMMIS). It is also apparent that the Research Study Team instituted or contemplated several research projects designed to fill out this framework. A brief summary of all the projects suggested will be included here as a means of tying together the concept of the program. Some of the projects should be considered short-term and concurrent in nature and others long-term efforts.

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[1] *Ibid.*, p. 6.

Research Projects[1]

On a long-term basis, research was to be directed to the area of methodology which would benefit MMMIS. The most important research in methodology was that concerned with military worth concepts and measures relevant to maintenance and material management. In addition, the development of maintainability/ availability models was essential as a basis of operational readiness measures such as Material Readiness Index and a Material Condition Indicator.

The Standard Ship and Aircraft Maintenance Planning and Control System (MPCS) was to be so designed that it would adequately serve as the source of the basic data. Development of MMMIS and MPCS would proceed concurrently.

The Logistics Research Project recognized weaknesses in the user questionnaire file and suggested a deeper probe in this area.

Another important facet of research into developing an MMMIS would be a thorough analysis of the Navy Service Test involving AFM 66-1 procedures and techniques.

The most important area, or the essence of designing an MMMIS in the opinion of the Logistics Research Project, was the establishment of a general set of principles to be used as guides

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[1] This section is a summary of the recommendations contained in Frank Segal's memorandum, Maintenance and Material Management Information System Research Considerations, loc. cit.

in designing several alternative versions of a MMMIS. These principles should evolve from research into methodology, the Maintenance Planning Control System (MPCS), the MMMIS questionnaire response file, and the Navy 66-1 service test. Development of appropriate models to balance the cost of implementing and maintaining a particular MMMIS version against its operational effectiveness constituted the next step so that the decision maker could evaluate each alternate MMMIS which had been designed.

Other areas of research concern the introduction of a Maintenance Planning and Control System and a Maintenance and Material Management Information System into Navy-related activity of private industry, other services, and government agencies under contract to the Navy for new construction, alterations, and maintenance. Research into financial and cost accounting systems is appropriate because of their interrelation with maintenance and material management systems.

The Research Study Team intended to develop an optimum location for the data processing facilities as the other research progressed. The characteristics of the basic maintenance documentation would also be developed in this manner. Specifically, development of the basic maintenance documentation would be the result of the questionnaire file, the service test of 66-1 and the comparison of systems and would round out the total research effort. Such documentation was to include the basic maintenance-

action recording document and the general management reports of maintenance information.

Research Results

It is difficult to find fault with the research effort being expended on MMMIS by the Project Group and the Research Study Team. The Team has taken detailed steps to determine the information considered necessary to effectively manage Navy maintenance. Painstaking research has been done to determine the source data available to provide the end products required, and when not available, how the source data can best be made available.

The design of the system, including the source document, processing facilities, and management products, is beginning to take form. The source document has been standardized and simplified so that one form suffices for all maintenance actions at the organizational level. This document will evolve further, however, due to the dynamic nature of the need for management information and the pressure for change by managers who feel that their wants were not satisfied in the first design. A conflict arises because the management products are statistical compromises and do not satisfy one hundred percent of the need for information.[1] An example of the pressure for change is the fact that the Navy

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[1] Interview with Commander W. E. Fannin, Office of Naval Research, (Code 436), December, 1964.

Comptroller is now working to include more cost data in the system.[1]

The bureaus have published manuals describing completely the preparation of the source document at the maintenance activity. Additional manuals will instruct personnel how to record cost data on the source document and how to punch this data onto machine cards.[2]

Keypunch operations are being located aboard all major ships, tenders and bases so that local maintenance source data can be punched onto machine cards for eventual transfer to computers. All primary naval operating bases and air stations have, or will have, computers for use in receiving the data from these cards and the preparation of maintenance reports for local use. Duplicates of the machine cards prepared at the local level are now being sent to The George Washington University Logistics Research Computer Center where the data are transferred to a computer in order to prepare higher level reports and build up the central data files. This operation will be phased over to the Maintenance Support Office at Mechanicsburg, Pennsylvania, within two years. At that time Mechanicsburg will become the central processing facility and the warehouse for the various

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[1] W. W. Hill, U. S. Department of the Navy, Office of Navy Management, Remarks made to the Navy Graduate Financial Management Class on January 24, 1965.

[2] _Naval Aviation Maintenance and Material Management Manual_, _loc. cit_.

computer files and models. All higher level management products will originate there.[1]

While the Maintenance and Material Management Information System seems well planned and designed, it is difficult on the basis of the above analysis to discern the amount of coordination taking place between the agencies affected by MMMIS. An attempt will be made in the following section to identify such cooperation, or the lack of it.

MMMIS Integration into Total Navy Requirements

Organization for Coordinating Information Systems

The coordinating agency in the Department of the Navy for management information programs was, until recently, the Navy Management Office (NMO). It was charged with providing for (a) coordination of requirements for orientation, training and staffing criteria; (b) maintenance and dissemination of information equipment; (c) control of procurement; and (d) consolidation, cross-servicing, establishment and disestablishment of punched card and electronic data processing installations to achieve more effective utilization and management.[2]

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[1] Interview with Dr. Robert Lundegard, Office of Naval Research, (Code 436), December, 1964.

[2] U. S. Department of the Navy Instruction SecNav P 10462.7, Data Processing in Management Information Systems, April 16, 1959, p. I-3.

The policy of the Department of the Navy was that the responsibility for developing computer based information systems rested firmly on the bureaus. In fulfilling this responsibility the bureaus were to be guided and governed by the policies and procedures promulgated by the Administrative Assistant to the Secretary of the Navy as the Department ADP Policy Official, the latter to be given support by the Navy Management Office.[1]

In effect, the Navy Management Office provided little more to information systems coordination than a device to keep track of equipment and approve or disapprove of plans to acquire equipment. This relationship did not prove to be satisfactory, as the Secretary of the Navy was not getting the type of information he needed, nor the proper representation in the planning for programs such as MMMIS and NCIS.[2]

The above situation has now changed. In February, 1965, a new concept in controlling information went into effect, resulting in a realignment of systems such as MMMIS in order to more nearly satisfy the Secretary's requirements for information, and afford more coordination between fiscal, engineering, supply and personnel interests.[3]

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[1] U. S. Department of the Navy Instruction SecNav P 10462.7A, Automatic Data Processing Equipment Program, February 26, 1964, p. IV-1.

[2] Hill, loc. cit.

[3] Interview with Earl Kuhl, U. S. Department of the Navy, Management Analysis Group, February 2, 1965.

Mr. Howard W. Merrill, the Special Assistant to the Secretary of the Navy, established the Office of Management Information Systems to replace the Data Processing Division of the Navy Management Office. The Office of Management Information Systems, headed by an Admiral, serves as an information command post and ensures that the needs of the Secretary are met by the various management information systems. The Systems Office does not plan installations. That function is left in the hands of the bureaus as long as the requirements of the Secretary are satisfied.[1]

Personnel in the old Office of Navy Management have indicated that the emphasis on management information for the Secretary, which resulted in the setting up of an organization to funnel all information through the information center, has a disciplining effect on the bureaus. The facts seem to support this opinion as seen below in the study of attempts to coordinate maintenance information between the various interested parties.[2]

Coordinating MMMIS at the Policy Level

Commander W. E. Fannin, of the Office of Naval Research, and a member of the Research Study Team, believes that the aggressive manner in which the Deputy Chief of Naval Operations for

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[1] *Ibid*.

[2] Interview with Arthur Feenan, U. S. Department of the Navy, Office of Navy Management, January, 1965.

Logistics approached the implementation of MMMIS has given the program a great deal of impetus.[1] As an example, when the usual pleading about lack of resources was made, the bureaus were informed that the program would be funded out of current monies, and nothing was to hold up its progress. Commander Fannin believes that several stumbling blocks were overcome due to the high powered makeup of the Steering Committee.

The power of this committee is further evidenced by the fact that the Office of the Navy Comptroller has been forced to abandon its original plans for a cost information system based on information flowing up through the accounting system--namely, through the Regional Finance Center computers. Instead, the cost information system is to be partially combined with the maintenance information system. This was borne out by remarks made by Rear Admiral Morris A. Hirsch, Deputy Comptroller, before the Navy Graduate Financial Management Class on February 11, 1965. Admiral Hirsch stated that the Comptroller was examining the financial information content of the various management systems, and would restructure the financial information system to mesh with the requirements of the major management information systems.

The above information indicates that coordination is taking place in top levels of authority. It should be noted, however, that the cost information system and the maintenance

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[1] Interview with Commander W. E. Fannin, Office of Naval Research, (Code 436), November 9, 1964.

information system have been in the process of being implemented for two years and only within the last few months has there been a concerted effort to coordinate them.[1] Further evidence of coordination problems is contained in a memorandum prepared on April 16, 1964, in the Bureau of Naval Weapons, commenting on an Office of Naval Research report concerning the Maintenance and Material Management Information System. The statement says:[2]

> We share your concern over the growing cleavage between development engineering, in-service maintenance engineering and supply. DOD Instruction 3200.6, OPNAV Instructions 3910.4A and 6A and BUWEPS Instruction 3910.2B all produce forces to tie the acquisition management and engineering processes and in-service maintenance engineering and support together. However, here we are confronted with a strange anomaly, in that each of these documents reflects strong inputs from the "F" (Readiness) Group. All of them except WR-30 were released by activities whose prime concern is RDT&E or program management. There is a deep difference in approach in the Office of the Secretary of Defense between the Installation and Logistics, Director of Defense Research and Engineering and Comptroller Groups. The Installations and Logistics Group leans towards the "Symington Plan and British Ministry of Supply" approach, the Director of Defense Research and Engineering and Comptroller Groups are tending to follow the principles published by Hitch and McKean, Peck and Scherer and Peter Drucker. The need for "sensible" integration of design and maintenance as co-equally flexible and responsive elements of a "system design" approach seems to be better understood in the OSD DDR&E and Comptroller area than it is in I&L.

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[1] Interview with Robert Greene, Office of the Navy Comptroller, Data Processing, November 13, 1964.

[2] U. S. Department of the Navy, Bureau of Naval Weapons, Memorandum, FWMP-1:JFW, April 16, 1964, p. 2.

Other frictions at the policy level are indicated in comments made in a memorandum from Rear Admiral E. C. Christiansen, Assistant Chief, Bureau of Weapons for Fleet Readiness and Training, on June 15, 1964.[1] In effect, the Assistant Chief, BUWEPS recommended that the Office of the Secretary of Defense take action to clearly define the Department of Defense Uniform Maintenance Data Collection System, Standard Data Coding programs and provide uniform definitions and classifications for the elements of cost and management information to be obtained by these systems. He claimed that the services were in the production systems, while the uniform Department of Defense maintenance data collection was still in preliminary design.

Taking note that there have been varying amounts of cooperation and coordination at the policy level, this analysis will proceed into the coordination at the working level of the organization.

Coordinating MMMIS at Lower Levels

MMMIS is being designed to report information pertaining to maintenance actions about people, material, dollars, activity, population, location and configuration. Because the system crosses so many organizational fences, it is extremely difficult

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[1] U. S. Department of the Navy, Bureau of Naval Weapons, Memorandum, FWMP-1/106:JFW, June 15, 1964, p. 3.

to coordinate. For instance, the Bureau of Supplies and Accounts has traditionally reported most material information, the Bureau of Weapons reliability and maintainability information, and the Comptroller the cost accounting information. The concept of the MMMIS program is to tie this all together without duplicating any reporting requirements. Problems arise in determining how each agency will get the information necessary to fulfill its responsibilities without duplicating efforts.[1]

Captain E. B. Stever, who has spearheaded the source document work of the Project Group, believes that the problems of coordinating the information gathering at the bureau and operating level have largely been solved. Representatives from all the bureaus and interested offices have worked on designing the source documents, and for the most part all parties are satisfied with progress at this point.[2]

This opinion is shared by Mr. Arthur Feenan of the Navy Management Office, who has responsibility for the Secretary level coordination of the MMMIS.[3] When asked if there was conflict

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[1] Interview with Jack Whitten, U. S. Department of the Navy, Bureau of Naval Weapons, Assistant Head, Maintenance Engineering Program Branch, November 4, 1964.

[2] Interview with Captain E. B. Stever, U. S. Department of the Navy, Office of the Chief of Naval Operations, Ship Material Readiness, December, 1964.

[3] Feenan, loc. cit.

between the various parties interested in the program (e.g., the various bureaus), he indicated that there was none. Commander Charles Braley, coordinator for the Bureau of Supplies and Accounts' portion of the MMMIS source document, also considered the progress satisfactory.[1]

Conversations with others throughout the bureaus, the Office of Naval Research and the Navy Management Office would indicate, however, that these points of view are not held by everyone connected with the program.[2] For example, there were opinions expressed that the Bureau of Supplies and Accounts delayed for over a year in defining the problem and cooperating in the design of a source document for use in determining the what, why and where of material usage. Another stumbling block was that the original comprehensive proposal by the Navy Comptroller for financial source material was turned down completely by the Research Study Team. Additionally, within the Bureau of Ships, interested parties were in conflict concerning the composition of the handbook for the program, which has placed that bureau many months behind the Bureau of Naval Weapons in implementing the system. The Bureau of Naval Personnel has also been rather vague and uninterested in working on manpower concepts

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[1] Telephone conversation with Commander Charles Braley, U. S. Department of the Navy, Bureau of Supplies and Accounts, MMMIS Coordinator, March 3, 1965.

[2] This material is based on impressions gained from approximately twenty interviews with personnel in all phases of the program.

for the maintenance information program. Many of these problem areas are hopefully being eliminated, however, as indicated in the following discussion.

In January, 1965, the MMMIS flow diagram looked basically like Figure 1 below. This form of reporting failed to include either material that had been consumed or useful cost accounting information concerning maintenance. The Bureau of Supplies and

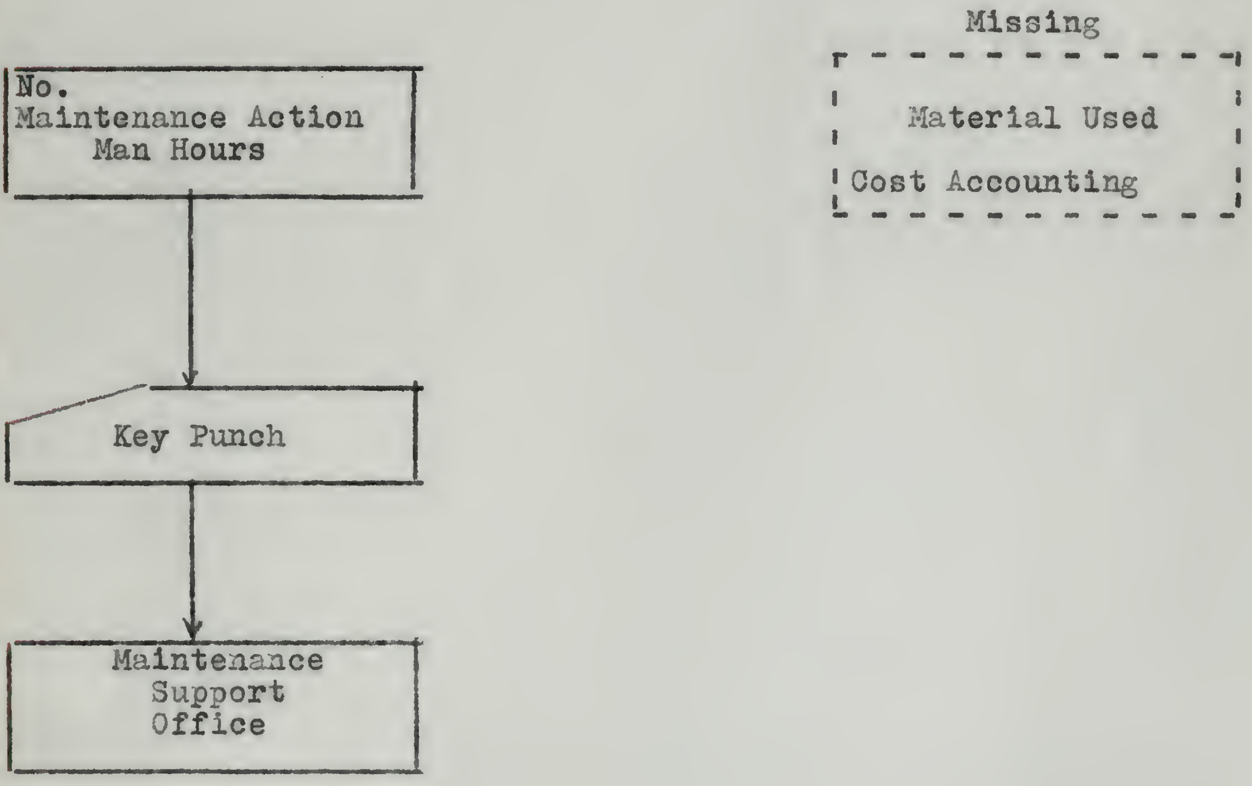

Figure 1.--Diagram of MMMIS Before Material Used and Cost Accounting Information Was Included.[a]

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[a] U. S. Department of the Navy, Office of Naval Research.

Accounts and the Navy Comptroller are starting to work aggressively on techniques to include this information in the system. During February and March of 1965, all the type commanders, major supply centers, and bureau representatives were working together on a source document for use in gathering consumption and financial information. The Comptroller entered into the design of this document insofar as cost accounting was involved. As a result, the program will look more like the diagram in Fegure 2, which would appear to be a significant step forward in coordinating the design of the system.[1]

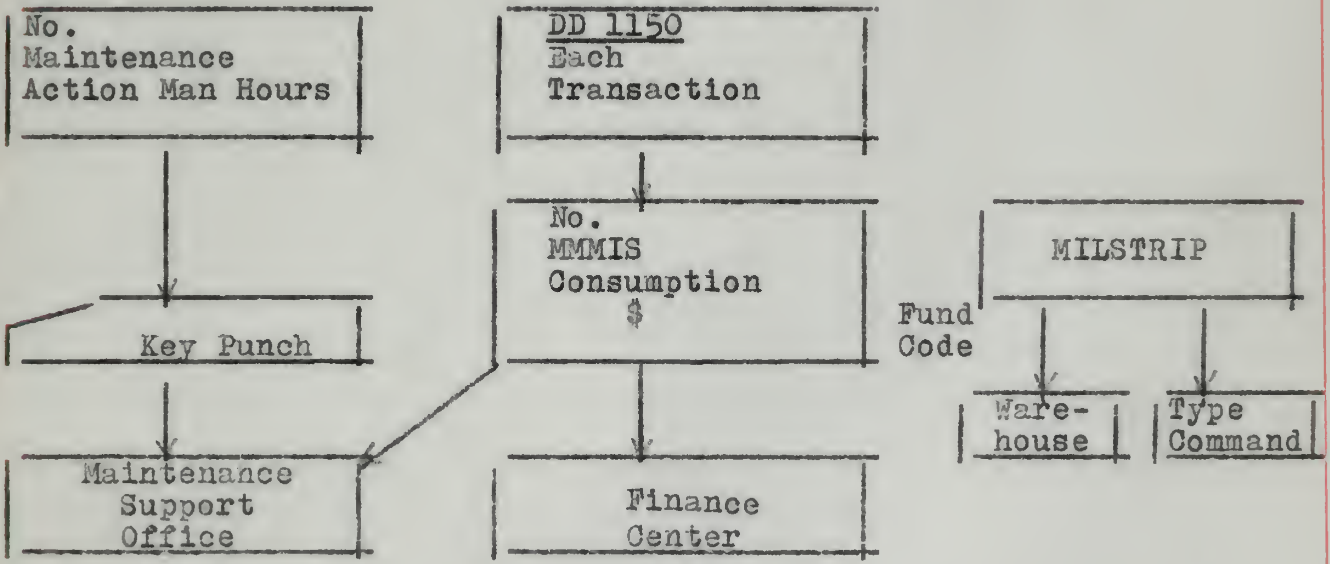

Figure 2.--Diagram of MMMIS With Material Used and Cost Accounting Information Included[a]

[a] U. S. Department of the Navy, Office of Naval Research.

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[1] Interview with Commander W. E. Fannin, Office of Naval Research (Code 436), March 3, 1965.

The Bureau of Personnel has started to support MMMIS wholeheartedly; as a result, the personnel people have been working very closely with the Office of Naval Research concerning personnel factors in MMMIS. Indicated in Figure 3 is the method officials from the two activities are using to build a file containing the relationship of the distribution of rates and

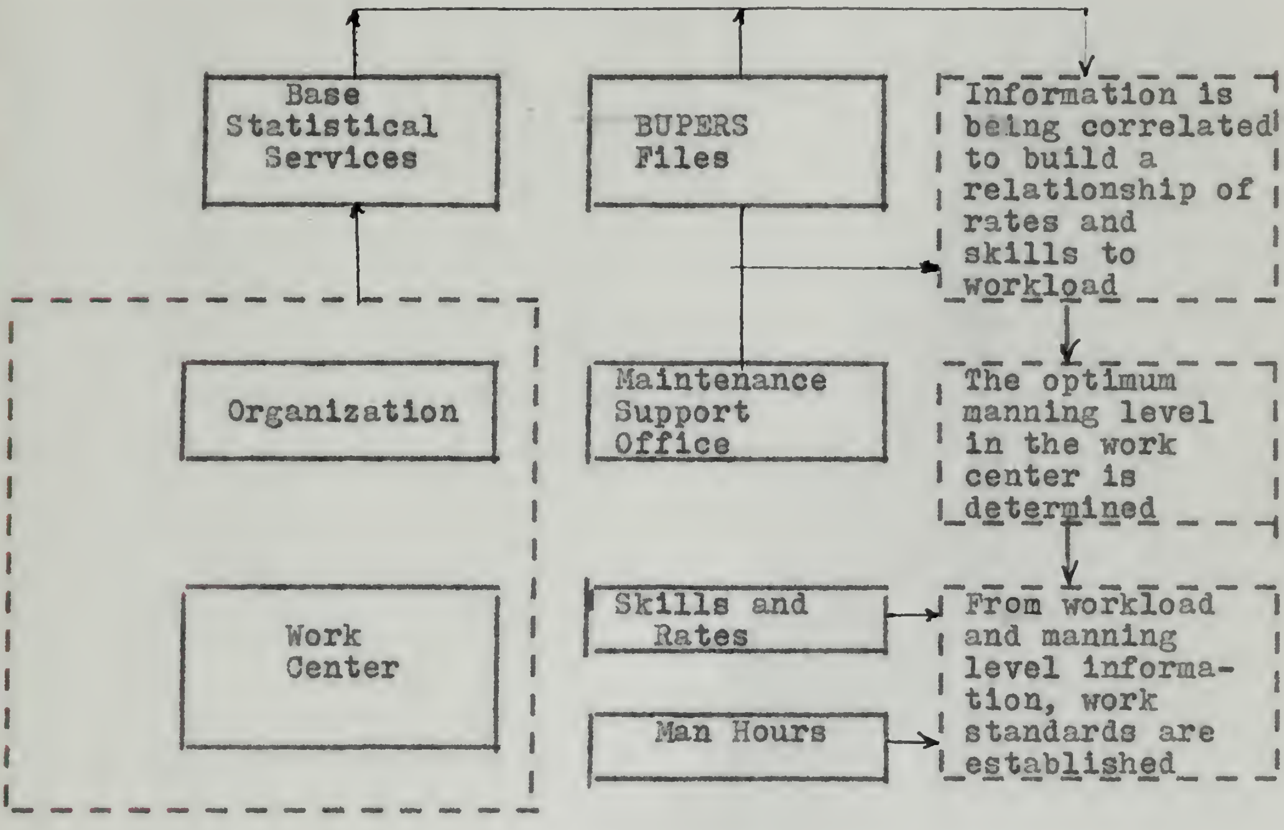

Figure 3.--Chart Depicting Coordination of Personnel Accounting and MMMIS.[a]

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[a] U. S. Department of the Navy, Office of Naval Research.

standard work hours required to accomplish different types of maintenance.[1]

The original research considerations for MMMIS included a readiness measurement concept. The officials responsible for readiness were not satisfied with MMMIS as a means of measuring daily readiness because of its slow speed; therefore, readiness measurement, except in a long-term sense, has been eliminated from the system by the Chief of Naval Operations. He will continue to align readiness reporting separate from MMMIS with some provision for trade-off of information.[2]

All of the plans for readiness reporting were in a fluid stage during the time research was done on this report. However, a Fleet Readiness Analysis System Plan was being developed which would provide for:[3] (1) a single readiness information system; (2) a directory of the information recorded in Navy ADP files; and (3) automatic retrieval of conclusions of long-term significance to readiness (such as presented in the reports of major exercises, operations, and operational analyses, and in the Annual Reports of the Commanders in Chief). One example of the

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[1] Captain Nicholas Brango, U. S. Department of the Navy, Bureau of Naval Personnel Memoranda prepared for the Office of Naval Research, 1965.

[2] Telephone conversation with Dr. Fredrick Moehle, Applied Physics Laboratory, March 4, 1965. (Dr. Moehle is considered by personnel in the Office of Naval Research to be an outstanding authority on military readiness measurement).

[3] U. S. Department of the Navy, Office of the Chief of Naval Operations, <u>Fleet Readiness System Development Plan</u>, 1965, p. 1.

importance of this to MMMIS is that flight hours and readiness condition reports will go to the Naval Information Center by dispatch or Automatic Data Network outside of the MMMIS and then selected portions of this information will be sent to the Maintenance Support Office for inclusion in the MMMIS files.

The progress of coordinating the MMMIS within the context of the Navy's total need for information has been satisfactory. Nevertheless, some friction develops because the bureaus are conscious of the fact that knowledge is power, and believe that the manager controlling the information system has the power. This is reflected in the struggle by each bureau and office to have an information system. However, careful design seems to be ensuring that a relatively integrated system can be implemented and still satisfy this legitimate desire for control of information by the responsible manager.

CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

Information Technology

An analysis of the planning carried out in the Navy's management information program reveals that several of the management concepts which were discussed in Chapter I have parallels in Navy management. For instance, a system that will report all maintenance activity to a central processing facility will certainly increase the quantity of information available to top managers in the Defense establishment. Additionally, the thought required in designing the system, and especially the designing of a collection method and end product report, is forcing the Navy to think through its management procedures thoroughly. The techniques of military worth measurements and cost effectiveness analysis point up shortcomings in military programs and spotlight strong points.

An attempt is being made, as indicated in the Logistics Research Project writings, to point the Maintenance and Material Management program towards a growth of decision power in the military establishment. Military worth measurements and systems

analyses procedures provide methods for decision making which aid in this growth. Because these methods are used at the top of the organization, the net effect in the military is to move the decision making level in the organization to a higher step.

If data enter the system at the shop level and are processed by machines for reports to the bureau and Department of Defense managers, several layers of middle people are eliminated from the information chain. This would suggest that some of the present Navy organizational layering is not necessary if much of the compilation and forwarding of data is taken over by the data system.

Whisler and Shultz mention the tendency to speed up decision-making as a result of the computer. Because automatic machines process data and prepare reports more rapidly than manual preparation, this would seem to be a characteristic of the Navy information system. Even more important to rapid decision making than the speed of gathering information is the capability of having a complete base of data available instantly. Comprehensive data files and models built up by modern information systems within the Navy have this characteristic.

The analogy between the concepts suggested by the academicians and those inherent in the Navy's computer based information systems is further apparent when the impact of the systems on organization in the military departments is noted. The systems are being implemented because of requirements of Department

of Defense for more complete information on the management of military assets in order to make decisions concerning these assets. This factor can be construed as a centralizing tendency for decision making, since the Department of Defense previously did not make such decisions. The people at the Chicago conference with Shultz and Whisler were correct when they said the pressures for change generated by the introduction of the new technology are in the direction of centralization of decision making, of control, and of coordination.

Systems Design Methodology

The recognized methodology necessary for planning and designing the type of information systems which would help the Navy embrace the concepts of this new technology was discussed in Chapter I. This was done to determine a yardstick for use in evaluating Navy planning and design of information systems.

Assuming that the "total-system" approach is the desirable goal in systems design, the material suggested that the first task in such a design is to determine the objectives and needs of the organization and to clearly understand the existing information system. By making a detailed study of the organization, it is possible to determine the long-range objectives and design of an information processing system that will enable it to operate more effectively with minimized managed costs. After such a study, most experts in system design suggest that the manager: (1) define

what system is being used at present; (2) evolve short-range improvements to the existing system; (3) establish a time schedule and assign responsibility for accomplishing the long-range objectives; and (4) accomplish the plan.

Navy's Goal of an Integrated System

The Secretary of the Navy established a goal in 1959 which called for the eventual integration of all management information systems. A time schedule and guideposts were established for the attainment of this goal. Design methodology similar to that suggested by most contemporary systems design experts was recommended by the Executive Office of the Secretary of the Navy for use by bureaus and offices planning information systems.

While the Navy had established the goal of a "total-system" several years ago, and indicated that it knew how this goal could be attained, there is evidence that progress was considerably slower than intended. This could possibly be explained because of a lack of central direction and impetus which should have been given by the Secretary of the Navy. Not until the Department of Defense started to pressure the services about unified readiness and budgetary reporting did the Navy begin to move forward rapidly in the area of computer supported management information systems.

Navy Management Information Systems

While the Navy may have been tardy in embracing the new information technology, it gives every indication of making up for

lost time. Chapter II contains a description of several of the many information systems the Navy is currently attempting to implement. This listing was made to highlight the magnitude of the information gathering problem in a large organization such as the Navy, and to determine the extent of duplication and overlap in the present Navy approach to the information problem.

Based on the descriptions contained in Chapter II, it appeared that several of the systems being used by the Navy have the same objectives or overlap. One example of this is the similarity in concept of Military Essentiality through Readiness Indices (METRI) and Maintenance and Material Management Information System (MMMIS), in that both were organized to utilize mathematical models of maintained assets as a decision-making tool. Another example is that the Maintenance and Material Management Information System includes manpower files almost identical to those envisioned for Enlisted Personnel Simulation System (MOON) and Computerized Advanced Personnel Requirements Information (CAPRI). Additionally, the Navy Cost Information System (NCIS) is being implemented to gather cost information on weapon systems and subsystems according to program element codes, while the concept of MMMIS includes similar maintenance cost accounting techniques plus standard cost techniques.

Several systems have enough factors in common that they offer outstanding opportunities for integration. The most likely prospects for integration are the Maintenance and Material

Management Information System and those systems which have been installed for reporting maintenance related information from shipyards and industrial naval air stations. Also, the Cost and Economic Information Systems, the Reliability Programs, the Navy Cost Information System, and the Maintenance Management Information System have enough important concepts in common to suggest that they require a considerable amount of trade-off among themselves.

Navy Design Methodology

In Chapter III the planning and design of the Maintenance Material Management Information System (MMMIS) was analyzed with the objective of determining how skilled the Navy was in making order out of the seeming chaos in management information. Considering the problems highlighted in Chapter II, and on the basis of its performance with MMMIS, are there any indications that the Navy has been able to make any progress towards an integrated system? Especially pertinent would be attempts to mesh MMMIS with the myriad systems within the Navy.

The analysis and documentation in Chapter III establish that the Navy, with the help of the Logistics Research Project at The George Washington University, has done an outstanding job of system design for the MMMIS program. An excellent organization was established to implement the program, and the necessary direction from the top down was evident. Similarly, the research

goals and project milestones were competently thought out.

There has always been the nagging problem, however, of coordinating the various managers' needs for information. This problem is documented at all levels of the Defense establishment from the Secretary down to the operating unit level. It is accentuated by the functional approach to management in the department in that each functional area has its own manager at several levels; consequently, management information systems reach down to the operational level in the manner of several parallel pipes. There is some modification of this in MMMIS, but as the system becomes less theory and more practice, it is beginning to show this parallel pipeline characteristic.

Conclusions

While it has been established that the Navy is capable of satisfactorily designing and coordinating such a complicated and comprehensive system as Maintenance and Material Management Information System (MMMIS), it has also been established that integrating all management information is a difficult task. This conclusion is based on two observations: First, the obvious need for each functional manager to have his own information system if the Department is to continue on a functional basis; second, the fact that the magnitude of the information gathering problem would swamp any integrated system. Even in the MMMIS program itself,

because of problems of coordination, the maintenance, material usage, readiness, and fiscal information gathering functions are evolving more in a parallel manner with trade-offs than as a single flow concept.

This analysis suggests that the Navy has three choices in the techniques it can use to manage information systems. At the one extreme, each bureau or major office would plan for its own information system. This is the stated policy of the Navy, with the exception that the Secretary's needs must be fulfilled by all divisions. At the other extreme, the Navy would centralize planning for information systems and design a monolithic system to include all reporting. The analysis indicates that a middle ground approach between these extremes is actually being used, especially when conflicts occur. The present method is not necessarily the ideal approach, but it works when enough pressure is applied from the top down, such as occurred to some extent in the Maintenance and Material Management Information System program.

It seems conclusive that the Navy cannot, as it had hoped, manage its information systems on a completely integrated basis. It is doubtful, however, that the goal of one integrated system was a desirable goal in the first place. Because of the sheer volume of information required by the various managers, the Navy would probably not be able to manipulate this information successfully. The best course is probably to integrate systems as much as possible, with each bureau being responsible for its own information gathering chores.

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